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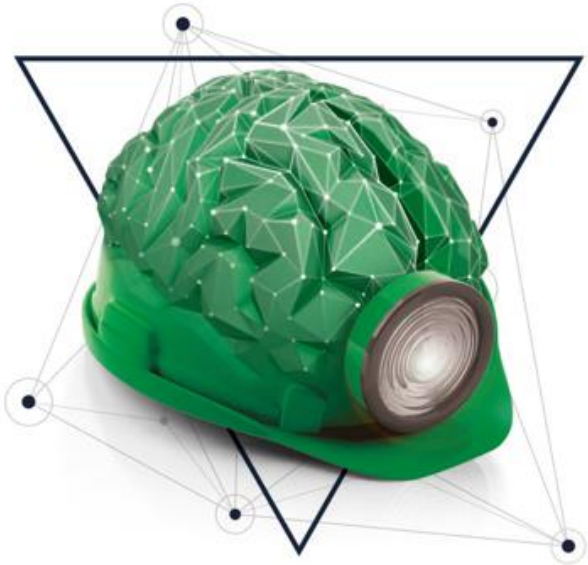
DIM ESEE-2 innovative workshop

DIM ESEE 2021: Innovation in exploration

Speaker: *Ferenc Mádai*

Date: 20 October 2021.

Lecture title: *General (EU) policy framework for need of innovative methods in mineral exploration*



October 20th – 22nd, 2021
IUC Dubrovnik, Croatia / online

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Introduction

- MSc Geological exploration, 1989 Moscow, MGRI
- LLM Mineral law and policy, 1998 Dundee, UK
- PhD earth sciences, 2004 Miskolc
- EU mineral policy-related pojects
  - INTRAW
  - MINLEX
  - ROBOMINERS
- EIP OG member

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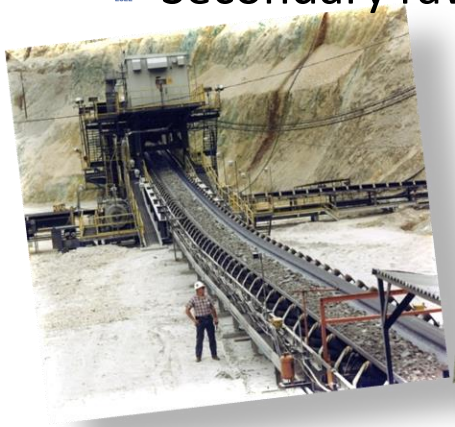
Faculty of Earth Science and Engineering, University of Miskolc

Education and research for **sustainable natural resources utilization**

- Primary mineral resources exploration and production
- Petroleum exploration and production
- Groundwater exploration and production
- Secondary raw materials from waste streams (recycling)



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„Is there a future for mining in the European Union? Or should the dependence on mineral resources from abroad be allowed to grow?"

(Luís Martins, 2021)

Conflicts:

- Permitting procedures
- Nature conservation (Natura 2000)
- Land use alternatives
- Public acceptance

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2021 ESEE

Specialties of Europe/EU

- High population ratio
- High ratio of land used by agriculture, industry, tourism
- Extractive sector in GDP: 1-3%
- Frontier of environmental legislation since 1980s
- Frontier of NIMBY approach since 1980s
- Outsorcing of mining and **reliance on import**

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The 2000s

- Raw materials dependence becomes critical
  - decades of policy decisions to outsource Europe's raw material requirements
- 2008: RMI, 3 pillars:
  - trade diplomacy,
  - sustainable development of domestic resources,
  - resource efficiency and recycling

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The 2010s

- Adoptation of technical screening criteria, the wider scope:
  - climate change mitigation;
  - climate change adaptation;
  - sustainable use and protection of water and marine resources;
  - transition to a circular economy; pollution prevention and control;
  - protection and restoration of biodiversity and ecosystems.
- Role of the mining and mineral exploration sector: delivery of raw materials in a sustainable and responsible way

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The 2010s

- The closer scope: EIP Strategic Implementation Plan 2013
  - Numerous Horizon 2020 R&I projects
  - EIT RawMaterials: „the world largest mineral- and metal-related formal knowledge and innovation community”
  - Raw Materials Scoreboard (2016, 2018, 2020)
- Updated CRM lists (2011, 2014, 2017, 2020)
- Launch of the Circular economy approach
- Little had been done in pillars 1 and 2 of the RMI

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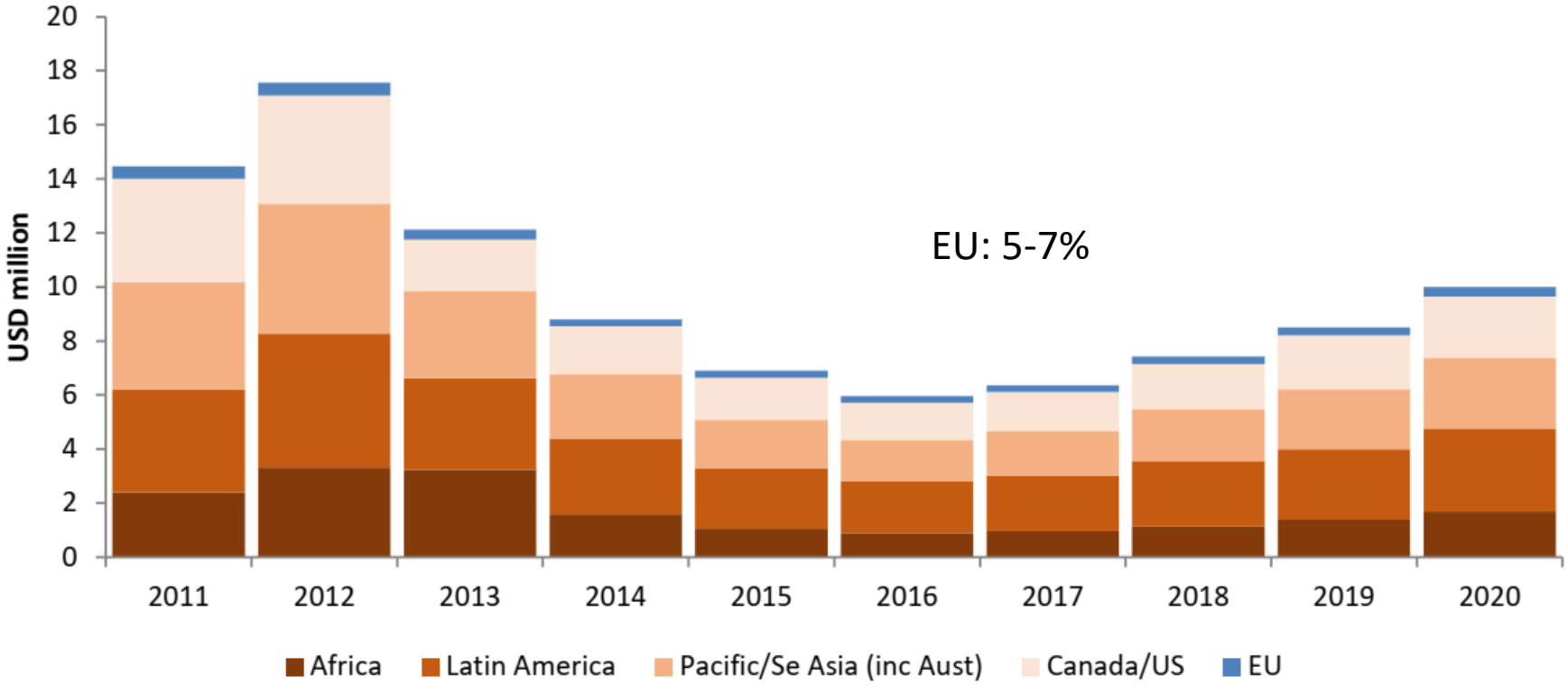
Exploration expenditures (nonferrous metals)



Miningintelligence.com

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Global distribution of exploration expenditure 1997 – 2017 (SNL database)

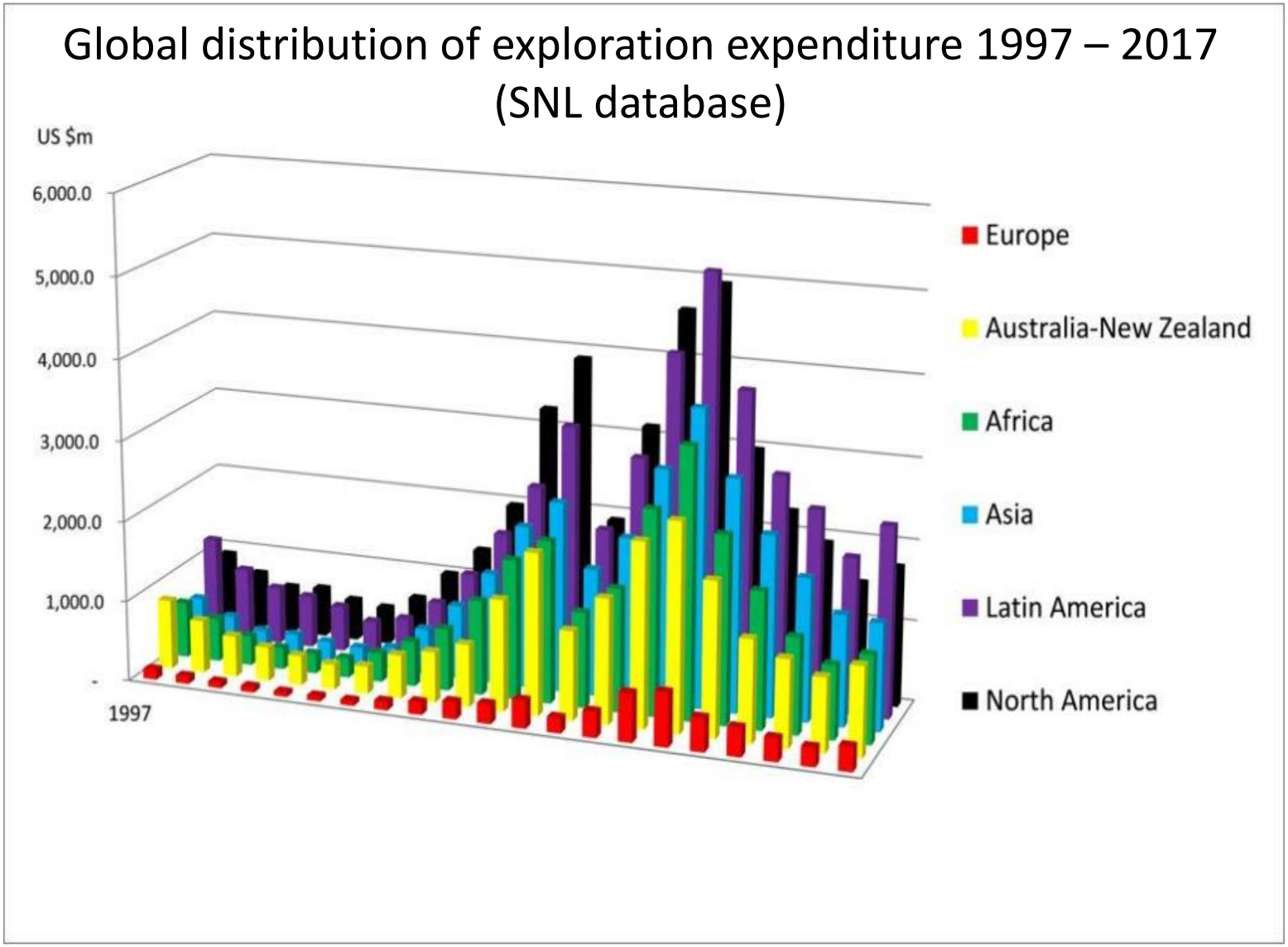

Figure 1: Global Distribution of Exploration Expenditure, 1997 –2017 (SNL Database).

Is the EU mineral exploration really negligable?

Exploration expenditures on base metals in 2017, Miningintelligence.com

Coutry(s)	Area M sq.km	Exploration expend. in 2017 (M USD)	Exploration expend. in 2017 (USD / sq.km)
EU	4.476	420	94
USA	9.834	670	68
Canada	9.985	1180	118

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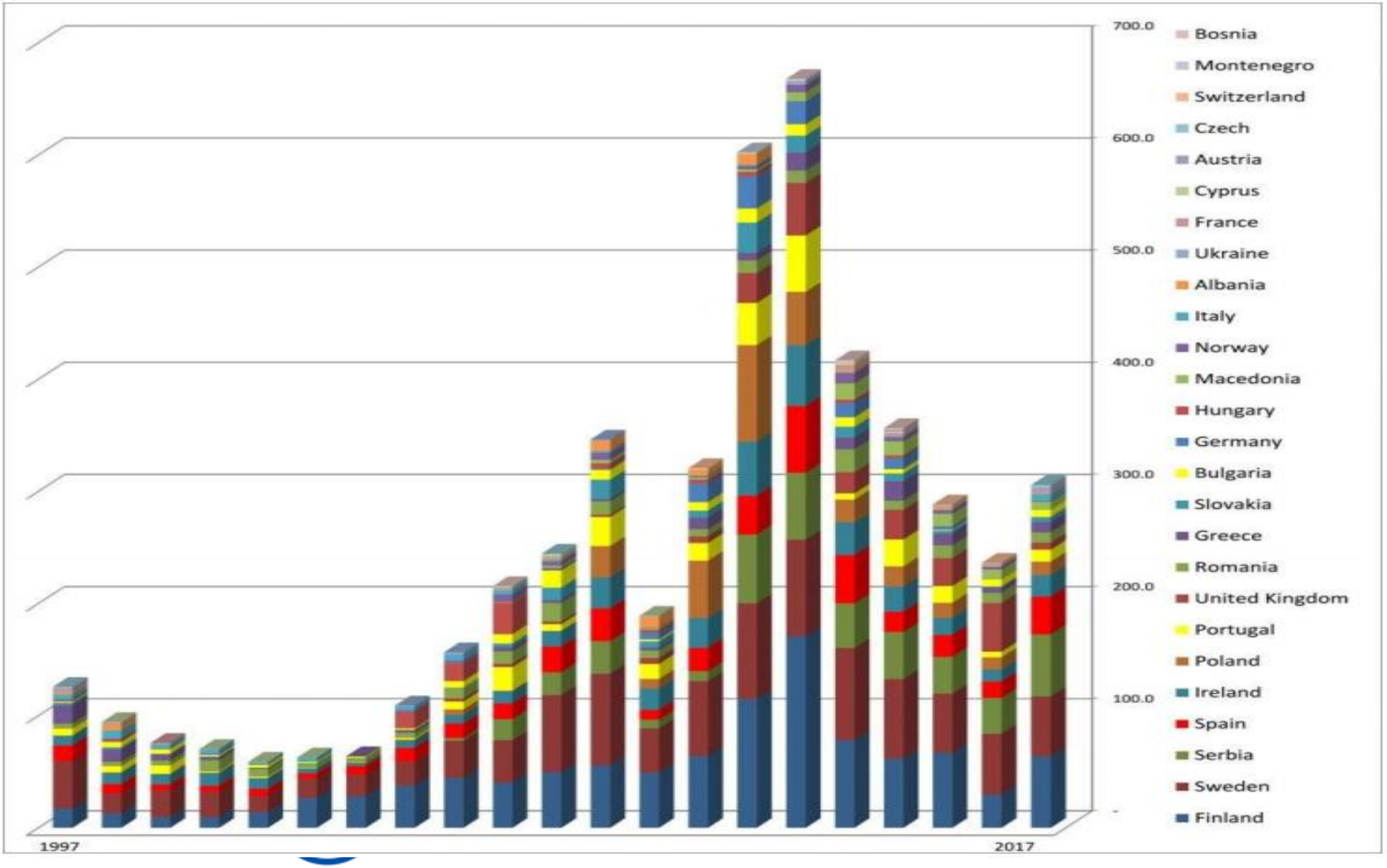
Distribution of exploration expenditure in Europe 1997-2017 (SNL database)



European discoveries

- Sakatti (Cu-Ni, Finland, 2008),
- Norra Kärr (REE, Sweden, 2009),
- Neves Corvo Semblana (Cu, Portugal, 2010),
- Cukaru Peki (Cu-Au, Serbia, 2012)
- Tara Deep (Zn-Pb, Ireland, 2012),

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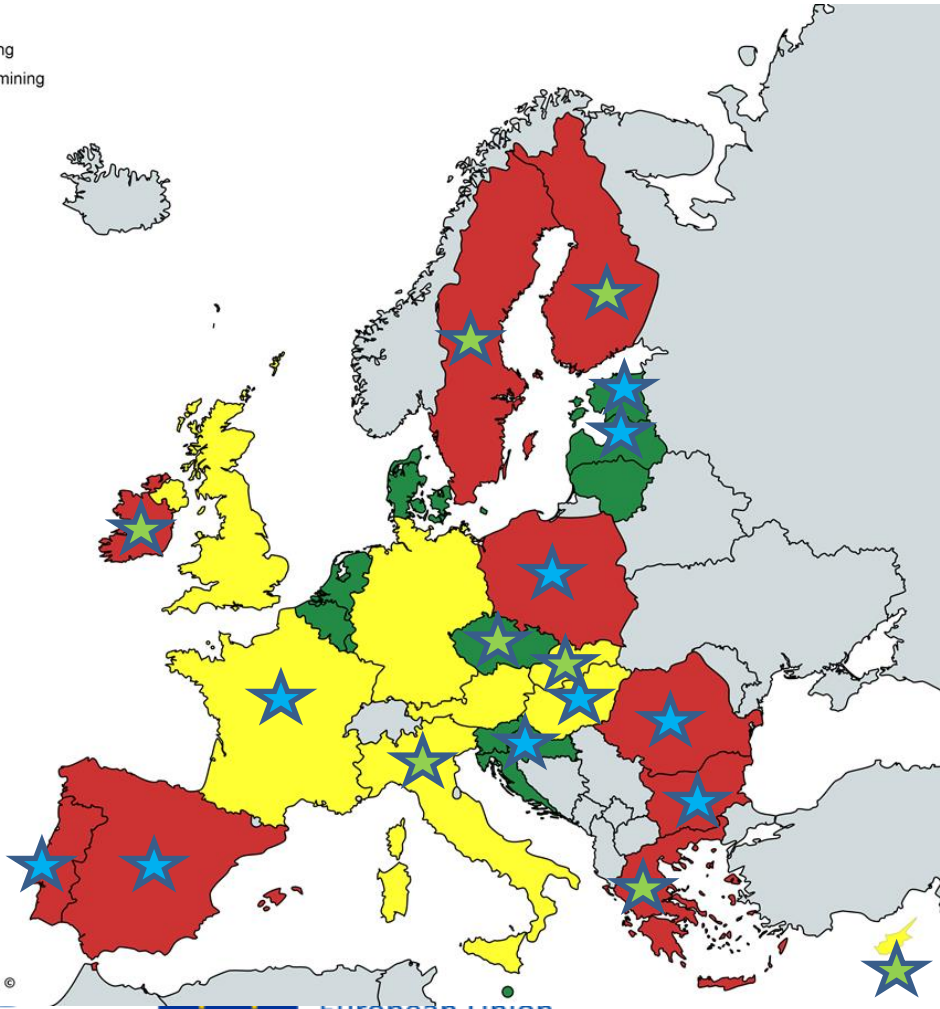
- Concession tendering applies
- First come approach

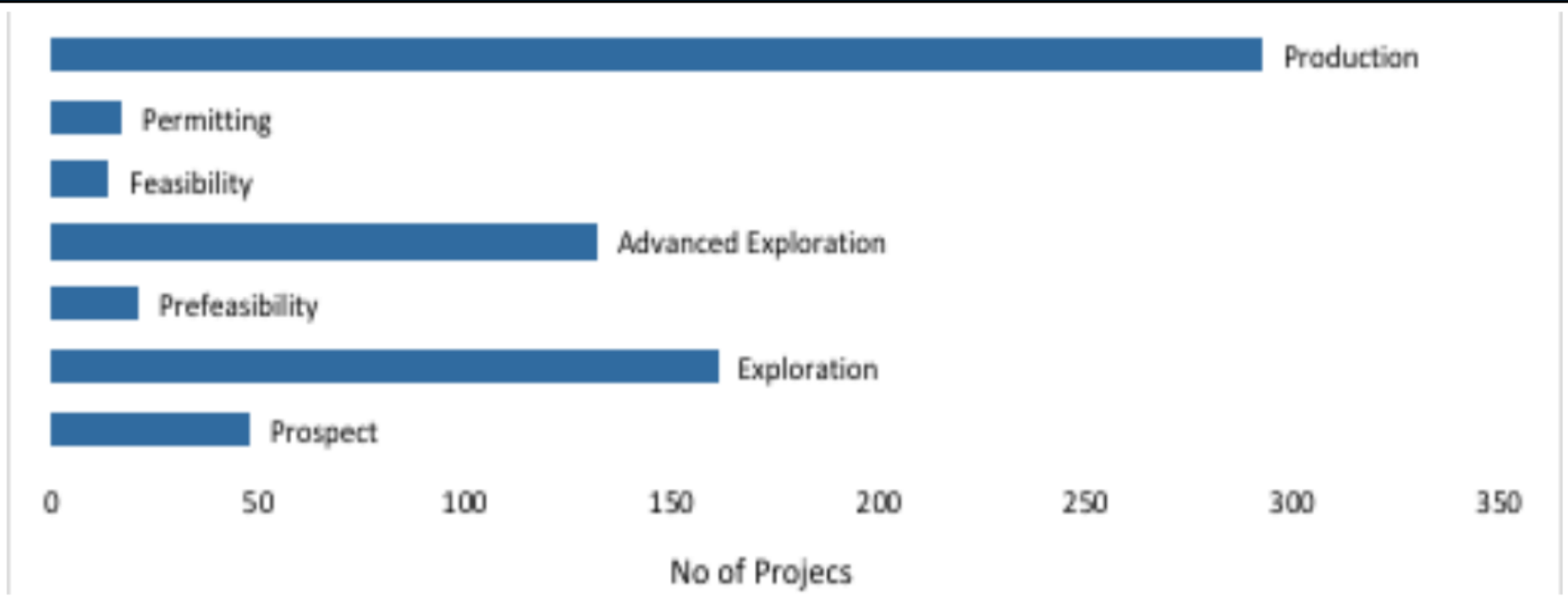
Fraser report 2016,
Investment Attractiveness Index

FI	85.56
SE	84.26
IE	83.13
PL	71.34
PT	70.86
ES	70.39
RO	56.57
BG	51.31
FR	50.1
EL	48.77
HU	47.41



Is the EU exploration sector healthy?

Number of mining projects in the EU (excl UK) by stage of development



Number of mining projects in the EU (excl UK) by country

EU based (active) exploration & mining operations (2018), Miningintelligence.com

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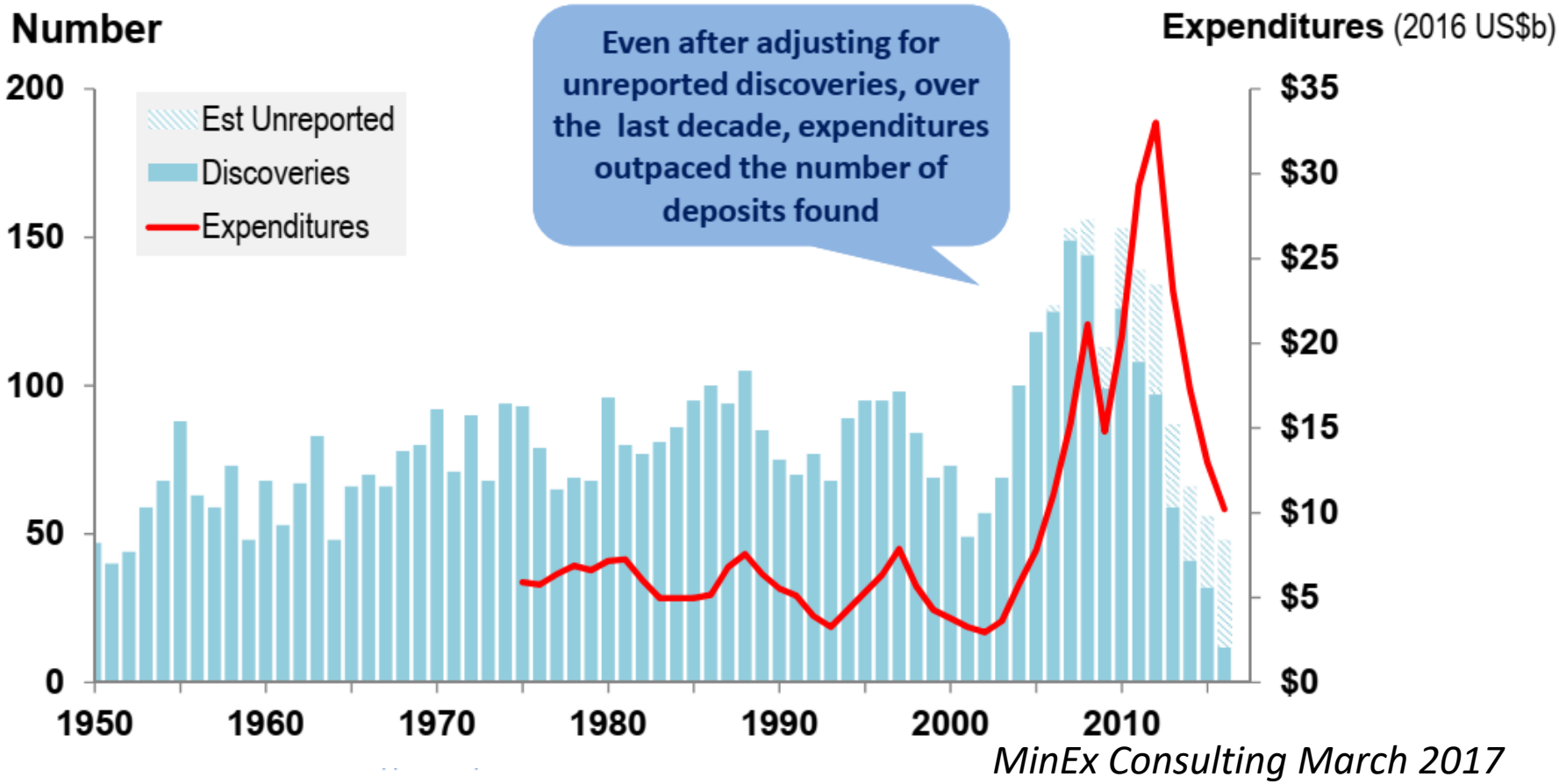
Mineral discoveries in the World : All Commodities : 1950-2016

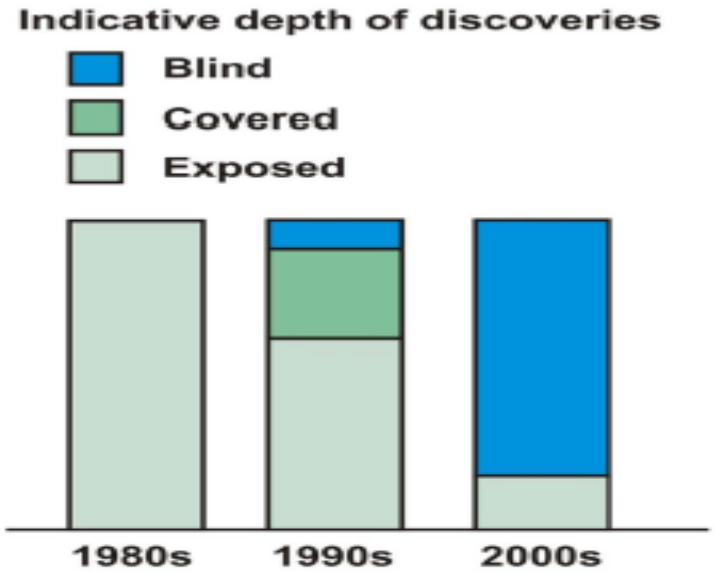


MinEx Consulting March 2017

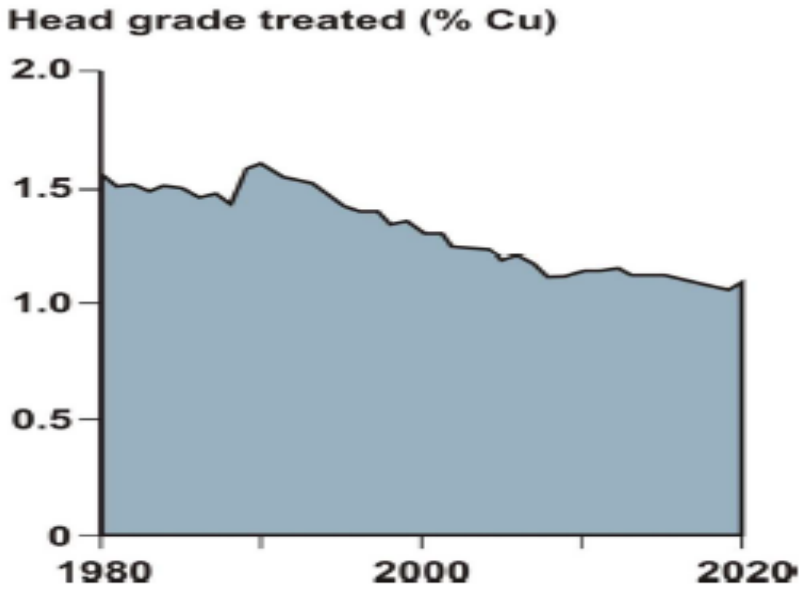
Exploration targets vs. depth

Greater Depths of Mining

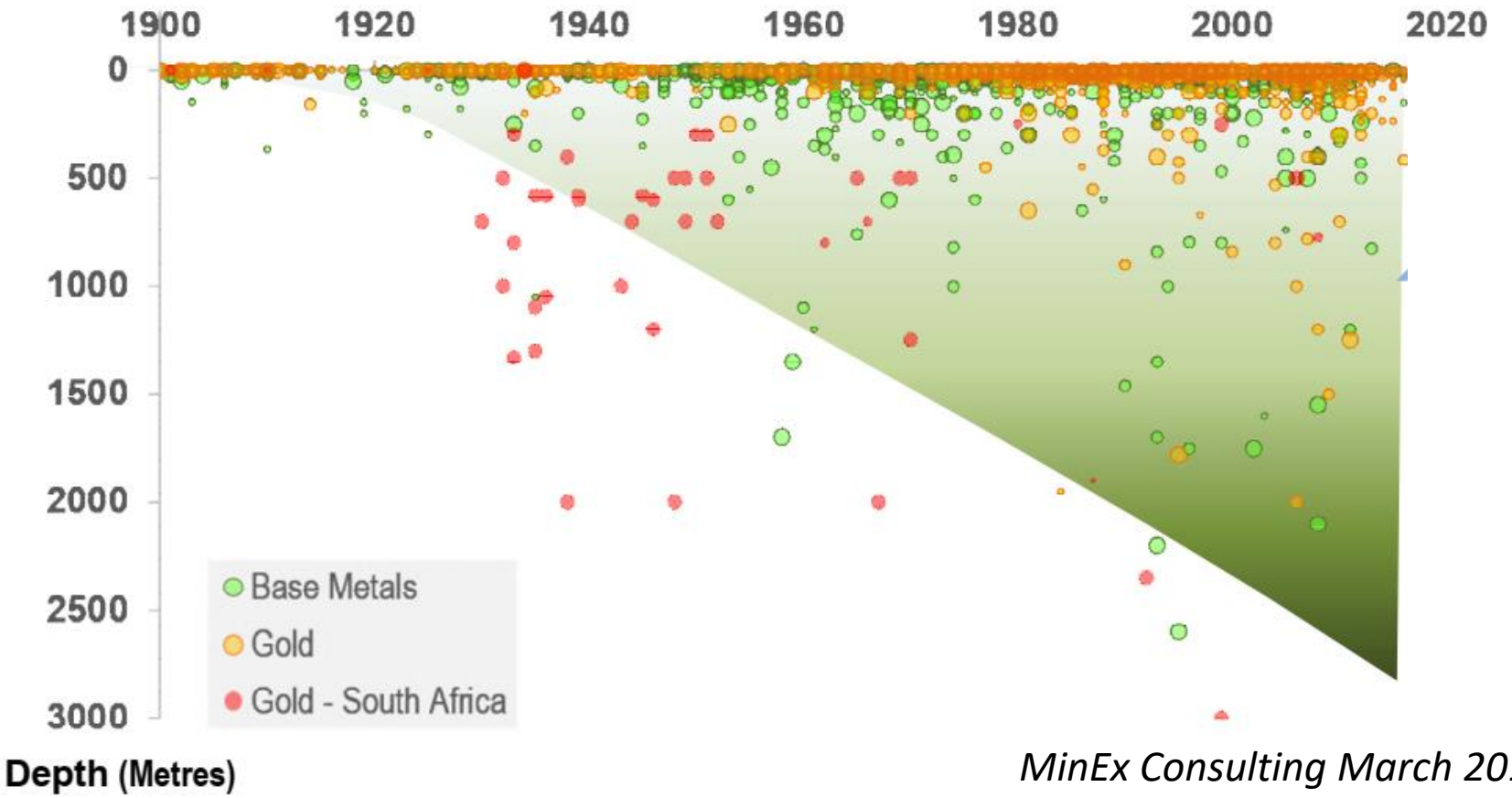
Greater Depth



Grades are Declining



Gold and Base Metal discoveries in the World : 1900-2016



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Availability of digitized data

- Current status: worse than for Africa
- Decline from the 1980s
- Large amount of data on paper, written in national language
- Validation of the data is important (if possible)

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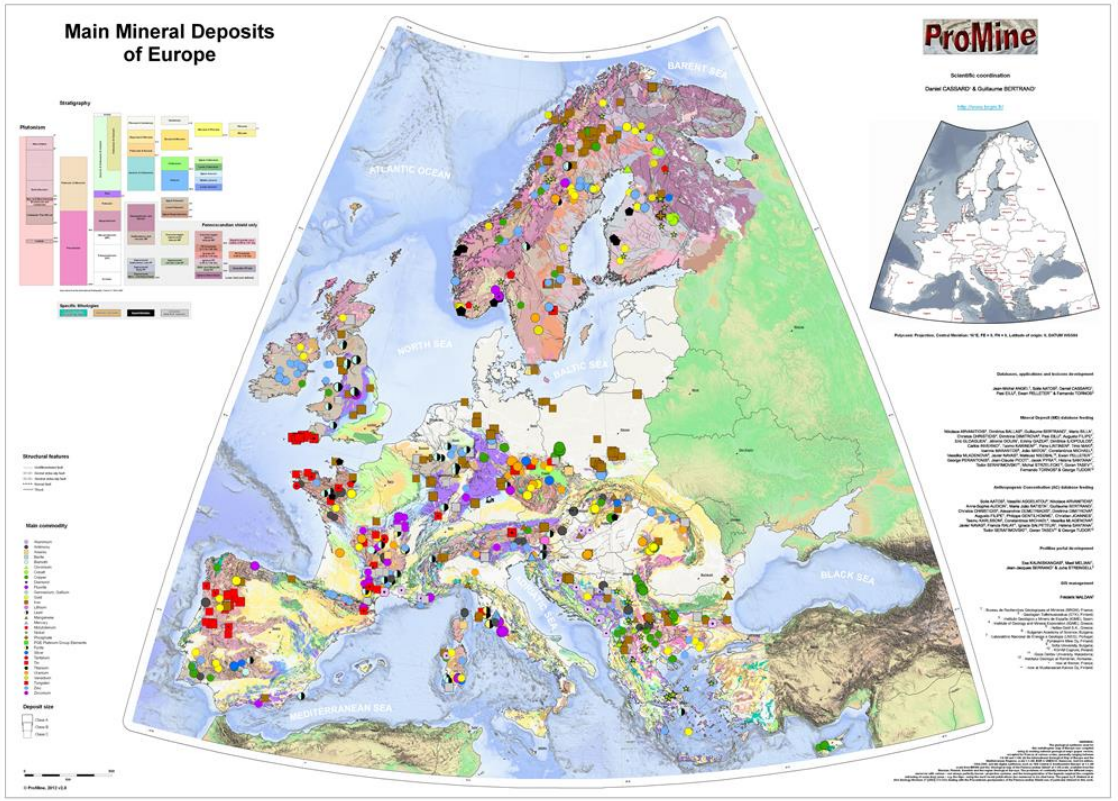
Achievements towards digitized databases

- PROMINE database
- Minerals4EU
- New HEU call projects



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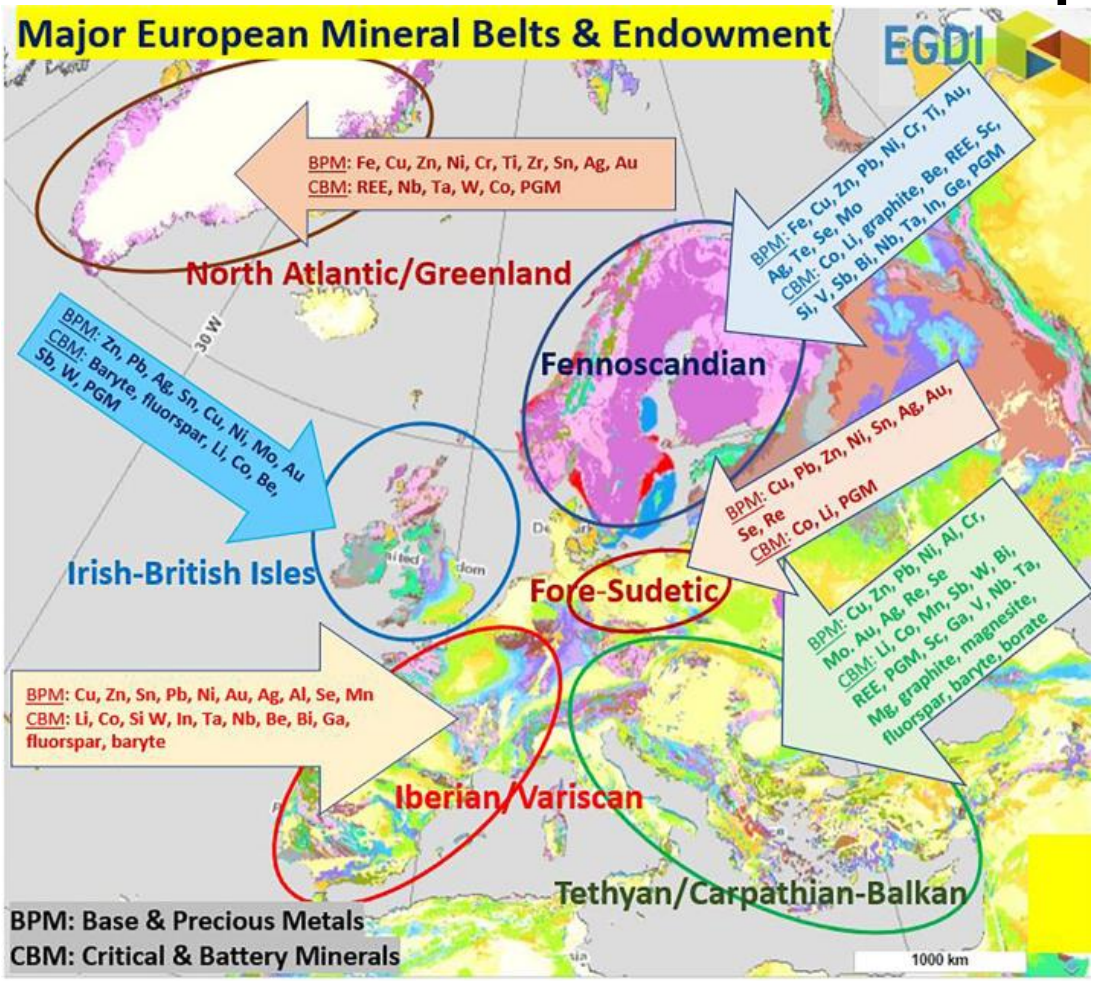
Potential in Europe (EGDI)



- Base and precious metals
- Critical and battery metals!!

Mineral diversity ←

	Finland	Sweden	France	UK	Czech	Spain	Portugal	Germany	Austria	Romania	Poland	Greece	Hungary	Italy	Slovakia	Cyprus	Bulgaria	Ireland	Belgium	Slovenia
Gold	✔	✔	✔	✔	✔	✔	✔		✔	✔		✔	✔		✔					
Silver	✔	✔			✔	✔	✔	✔		✔			✔		✔					
Copper	✔	✔		✔		✔	✔	✔		✔	✔	✔	✔	✔	✔	✔				
Antimony			✔						✔				✔		✔					✔
Bismuth			✔	✔		✔														
Tungsten			✔	✔		✔	✔	✔	✔											
Tin			✔	✔	✔	✔	✔	✔												
Indium			✔	✔	✔	✔	✔	✔									✔			
Gallium			✔		✔				✔											
Germanium			✔		✔			✔	✔	✔	✔			✔			✔	✔		
Nickel	✔	✔										✔								
Chromium	✔	✔										✔				✔				
Cobalt	✔	✔										✔								
PGEs	✔	✔																		
Zinc	✔	✔	✔	✔		✔	✔	✔		✔	✔			✔		✔		✔	✔	
Lead	✔	✔	✔	✔		✔	✔	✔		✔	✔			✔		✔		✔	✔	
Graphite	✔	✔			✔				✔											
Phosphate	✔	✔	✔														✔		✔	
Iron	✔	✔									✔			✔						

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EU-supported research (H2020 projects)

- **HiTech AlkCarb**: New geomodels to explore high-tech raw materials (Nb, Ta, Nd, Sc) in alkaline igneous rocks and carbonatites
- **ROBUST**: autonomous robotic survey system for deep sea polymetallic nodules
- **UNEXMIN**: robotic survey to explore and map flooded mines

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EU-supported research (H2020 projects)

- **SOLSA**: sonic drilling, analytical equipment and informatics to optimize mining operations performance
- **INFACT**: innovative, non-invasive and socially acceptable, low-inpact mineral exploration technologies
- **Smart-Exploration**: cost-effective and environmentally friendly solutions for deep mineral exploration

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2021 ESEE

Requirements for 2020s

- Quadroupling of mineral raw material requirements for clean energy technologies by 2040
- Resources close to their point of incorporation to products / market of products
- Reducing dependence on transglobal supply chains,
- Ensuring production within well-regulated jurisdictions, adoption of best available technologies
- Recycling will not eliminate the need for continued investment in the discovery, delineation and development of new resources

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Action Plan on Raw Materials (EC, 2020)

- titled “Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability”
- 10 action points for the period 2021-2027
  - Establishment a European Raw Materials Alliance
  - Improvement of the regulatory framework and financing criteria
  - Mining, processing and recycling focus
  - Two of them are exploration-related:
    - Earth observation programs and remote sensing
    - Horizon Europe R&I projects

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New Horizon EU calls

- Innovation for responsible EU sourcing of primary raw materials, the foundation of the Green Deal
  - Developing new genetic models for ore deposit types that host critical minerals in order to identify areas for exploration, especially in previously overlooked regions
  - Deploying innovative geological, geophysical, geochemical, and data analysis approaches including modelling techniques (e.g. data analysis, remote sensing) to elucidate the geological history and structure and models of targeted spatial areas of targeted areas and to guide more environmentally friendly exploration for critical minerals, limiting impacts on biodiversity.
- Monitoring and supervising system for exploration and future exploitation activities in the deep sea
- Earth observation technologies for the mining life cycle in support of EU autonomy and transition to a climate-neutral economy

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Tools and solutions presented here

- Validation and reassessment of brownfield sites: underwater exploration – ***Norbert Zajzon, Richárd Papp***
- Robotic solutions for seabed exploration – ***Norbert Zajzon***
- Minor component geochemistry: on-site spectroscopy, resource vectoring and genetic modeling – ***István Márton***
- Drone-based survey solutions – ***Boglárka Topa, Richárd Papp***
- Non-invasive technologies, geophysical solutions – ***Endre Nádasi***
- Data processing and modeling – ***Norbert Péter Szabó***

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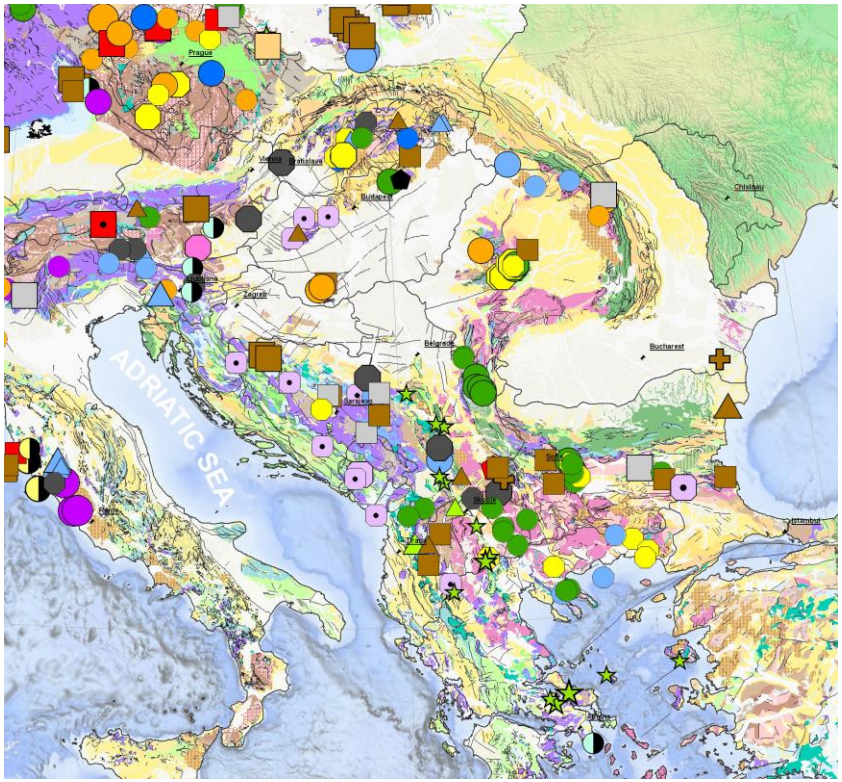

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